Remarks

In the Office Action dated January 10, 2005, the Examiner objected to claims 1-33. The Examiner rejected claims 1-33 under 35 U.S.C. § 102 as being anticipated by the publication entitled "A Monolithic 3-Axis Silicon Capacitive Accelerometer with Micro-g Resolution" by Chae, et al. The Examiner rejected claims 1-4, 6-11, 15, 16, 18-19 and 21-27 under 35 U.S.C. § 102 as being anticipated by the Japanese publication 2001-264355 in the name of Kato. The Examiner rejected claims 1-27 under 35 U.S.C. § 102 as being anticipated by the U.S. Patent to Yazdi, et al. 6,035,714. The Examiner rejected claims 1-4, 6-11 and 15-27 under 35 U.S.C. § 102 as being anticipated by the publication entitled "An Inertial Sensor Technology Using DRIE and Wafer Bonding with Interconnecting Capability" by Ishihara, et al. The Examiner rejected claims 28-33 under 35 U.S.C. § 103 as being unpatentable over either Kato or Yazdi, et al or the publication by Ishihara, et al. in view of either U.S. Patent No. 4,711,128 or German patent publication 19750350 in the name of Qu, et al. or the publication by Chae, et al.

By this Amendment, Applicants' Attorney has amended each of the independent claims to more particularly point out and distinctly claim what Applicants regard as their invention. In particular, each of the independent claims 1 and 28 have been amended to make it clearer that: the input axis is a lateral input axis; the top and bottom surfaces are spaced apart along a z-axis substantially perpendicular to the input axis; a first pair of side surfaces are spaced apart along the input axis; and a second pair of side surfaces are spaced apart along a lateral dimension of the proofmass wherein at least one of the first pair of side surfaces is normal to the input axis and extends along the lateral dimension. The proofmass is movable against acceleration relative to at least one electrode due to initial force along the input axis to obtain a lateral capacitive variation wherein the side surface of the at least one electrode and the at least one of the first pair of side surfaces are spaced apart and to define a narrow high aspect ratio sensing gap which extends along substantially an entire lateral dimension of the proofmass.

The advantages of such an arrangement are numerous. For example, such a capacitive lateral accelerometer has high sensitivity and low noise. In particular, the high aspect ratio sensing gap which extends along substantially the entire lateral dimension such as a width of the proofmass is provided to achieve a high sensitivity and low noise characteristics which thereby provide a large signal-to-noise ratio.

With respect to the prior art, the publication by Chae, et al. was published in June of 2003 as indicated under the Selected Publications section of the enclosed resume of one of the named co-inventors of this application.

With respect to the Japanese patent document in the name of Kato, there does not appear to be a capacitive gap between measuring electrodes 16A and 16B and the vibrator 11. Figure 1 of Kato shows the electrodes 16A and 16B and the vibrator 11 electrically coupled together prior to electrical connection to block 34. Also, as illustrated in Figure 3 of Kato, it appears that members 12A and B form capacitor C1 and C2 with the vibrator 11, respectively. Furthermore, the electrodes of Kato do not extend along substantially the entire lateral dimension of a proofmass as required by each of the independent claims of the application.

With respect to the U.S. Patent to Yazdi, et al, the independent claims of the present application have been amended to make it clearer that the independent claims require a lateral accelerometer device and not a z-axis accelerometer device as disclosed and claimed in Yazdi, et al.

With respect to the publication by Ishihara, et al., Ishihara, et al. fails to disclose a narrow high aspect ratio sensing gap which extends along substantially an entire lateral dimension of the proofmass wherein the sensing gap is defined by the surface of at least one electrode and at least one of a first pair of side surfaces of the proofmass.

Consequently, in view of the above and in the absence of better art, Applicants' Attorney respectfully submits the application is in condition for allowance which allowance is respectfully requested.

Respectfully submitted,

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Date: March 17, 2005

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RESEARCH INTERESTS

- Micro-Electro-Mechanical System (MEMS)
- Micro Fabrication Technology
- MEMS Device Integration with Interface Readout electronics
- Analog and Digital Integrated Circuits

EDUCATION

Jan. 2001 – Jan. 2003	**Ph. D. :**	Electrical Engineering and Computer Science, The University Of Michigan, Ann Arbor, MI
	Emphasis:	Multi-axis Micro-Gravity Micromachined Accelerometers
Sep. 1998 – Dec. 2000	**M.S.E. :**	Electrical Engineering and Computer Science, The University Of Michigan, Ann Arbor, MI
	GPA:	3.81/4.00
Mar. 1992 – Feb. 1998	**B.S. :**	Metallurgical Engineering (Material Science & Engineering), Korea University, Seoul, Korea.
	GPA:	3.3/4.00 (High Honor)

WORK EXPERIENCE

Feb. 2003 – Present **Research Fellow, The University of Michigan, Ann Arbor, MI**
High performance bulk-micromachined vacuum gauge (Pirani gauge)

Sep. 2002 – Jan. 2003 **Graduate Student Instructor, The University of Michigan, Ann Arbor, MI**
Electrical Engineering and Computer Science
Instructor for EECS 311, Electronic Circuits

Sep. 1998 - Sep. 2002 **Graduate Student Research Assistant, The University of Michigan, Ann Arbor, MI**
Electrical Engineering and Computer Science
Development of multi-axis micromachined accelerometers with micro-g resolution

HONORS

Feb. 2002 **Finalist** of the **2002 Pryor-Hale Business Plan Competition,** organized by Business School of The University of Michigan with Micro-g precision accelerometers.

Jun. 2001 **1st Place Award in 2001 Student Design Contest** (Conceptual Category) which is organized by University of Michigan among a number of universities in the world and sponsored by CADENCE, Mentor Graphics, TI, IBM, Intel, Compaq, AMD, Lucent Tech., Dallas Semiconductor, QualComm and Design Automation Conference 2001.
Title: "Two-Dimensional Position Detection System with MEMS Accelerometer for MOUSE Application"
(with Seungbae Lee, Gijoon Nam, Hanseup Kim, and Alan Drake)

SELECTED PUBLICATIONS

- K. Najafi, J. Chae, H. Kulah, and G. He, "Micromachined Silicon Accelerometers And Gyroscopes," The Proceedings of the 2003 IEEE/RSJ International Conference on Intelligent Robots and Systems, Las Vegas, NV, Oct. 2003.
- J. Chae, H. Kulah and K. Najafi, "A Monolithic 3-Axis Silicon Capacitive Accelerometer with Micro-g Resolution," Transducers 2003, Boston, MA, June 2003.
- H. Kulah, J. Chae and K. Najafi, "Noise Analysis and Characterization of A Sigma-Delta Capacitive Silicon Microaccelerometers," Transducers 2003, Boston, MA, June 2003.
- H. Kulah, J. Chae, N. Yazdi and K. Najafi, "A Multi-Step Electromechanical Sigma-Delta Converter for Micro-g Capacitive Accelerometers," ISSCC 2003, San Francisco, February 2003.
- J. Chae, H. Kulah, and K. Najafi, "An All-Silicon In-Plane High-Sensitivity Low-Noise Micro-G Micromachined Accelerometer," MEMS 2003, Kyoto, Japan, January 2003.
- J. Chae, H. Kulah, and K. Najafi, "A Hybrid Silicon-On-Glass (SOG) Lateral Micro-Accelerometer with CMOS Readout Circuitry", MEMS 2002, Las Vegas, NV, January 2002.
- S. Lee, G. Nam, J. Chae, H. Kim, and A. J. Drake, "Two-Dimensional Position Detection System with MEMS Accelerometers for MOUSE Applications", DAC 2001, Las Vegas, NV, June 2001.
- J. Chae, H. Kulah, A. Salian, and K. Najafi, "A High Sensitivity Silicon-on-Glass Lateral Micro-g Micro-accelerometer", Nanospace 2000, Houston, TX, January 2000.

ACTIVITIES

1998 -	**IEEE** Student Member
LANGUAGES	English, Japanese, Korean
HOBBIES	Traveling, Playing billiard, and Listening music.
REFERENCES	Available upon request.